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Letters to the Editor

Curve of transmission of Chelsea filter *

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1. Introduction

The Chelsea filter is made in the form of a hand loupe. The producer (Gemmological Instruments Ltd., London) says in trade information that the filter consists of a combination of two gelatin filters designed to transmit only deep-red and yellow-green light. These gelatin filters were chosen to match the unusual spectral response of the emerald which transmits deep-red but absorbs yellow-green light. When green gems are strongly illuminated through this filter with white light (standard illuminants C), then the genuine gems (e.g., emerald, demantoid, zircon) have distinct red or pinkish colour (depending on the depth of colour of the monocrystal), while the yellow glass and the doublets will appear green.

2. Measurement

Since the producer, besides the trade information, does not give any precise information about the spectrum of the filter or about the essential parameters, such as percentage values of transmission at the maximum T_{max} and the spectral width s, it has been decided to investigate the curve of transmission of the Chelsea filter. A second compelling argument for the study of the function $T=f(1/\lambda)$ was the fact that so far no institution in Poland interested in these problems has undertaken the study on this subject. The transmission spectrum of the Chelsea filter was obtained by means of a spectrophotometer SPECORD UV VIS in the visible range (333 nm–800 nm). The spectrum is represented by the shape (outlined by the spectrophotometer pen) of the function $T=f(1/\lambda)$, in the figure [1].

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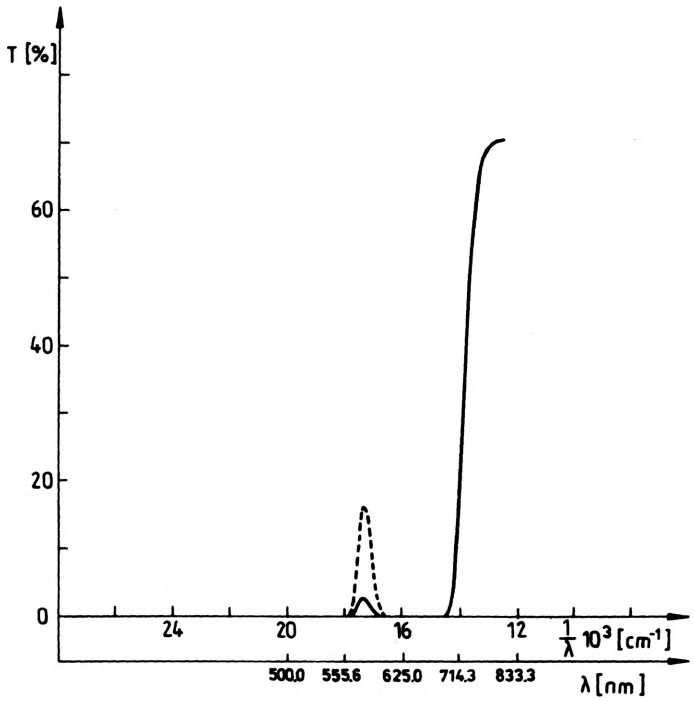

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3. Results and conclusions

It resulted that the distinctive transmission characteristic of the Chelsea filter equals zero at 333 nm–361.4 nm and 607.7 nm–684.5 nm and increases distinctly for $\lambda > 684.5$ nm, reaching the value $T \cong 70\%$ in the region of λ which responds in the deep-red colour. In addition, note that the minor maximum at $\lambda_0 \cong 578.7$ nm. In order to describe more precisely the magnitude of the transmission T_0 for λ_0, and the spectral width s, the amplitude of spectrophotometer pen was 5 times increased. This allowed us to obtain the contour of the transmission curve maximum of the Chelsea filter which was outlined with a dotted line.

The calculated value of the transmissions equals $T_0 = \pm \Delta T = 3.2 \pm 0.1\%$, when ΔT (the accuracy of reading) based on the diagram.

The spectral width equals $s \pm \Delta s = 17.35 \pm 2.9$ nm, when $\Delta s = f(\Delta x)$ and $\Delta x = 0.5$ nm (accuracy of reading based on the diagram).

References

[1] PŁASZYŃSKA M., Doctor's Thesis. Main Library of the Academy of Economics, Cracow 1985, pp. 53–54, 165–167 (in Polish).

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